

Design & Build a Slurry Transfer Control & Monitoring System on the ATM 140 Spray Dryer using Microcontroller with Ultrasonic Sensors

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Abstract- In the current developments automation systems have begun to be applied to the industrial world, including the ceramic or tile industry. The ceramic industry in the main raw materials is soil, processing or mixing soil from crusher machines that will be produced into slurry materials (slurry) using milling time continuous (MTC), spray dryer pump machines to distribute slurries from the reservoir center to the ATM 140 reservoir. Often experiences overload slurry on atm 140 reservoirs because the system still uses switch. The operator still turns off the pump manually when there is an overload, based on these problems, an innovation is needed for an innovative slurry transfer control and monitoring tool on the ATM 140 spray dryer using an ultrasonic microcontroller-based sensor and the percentage of the contents of the reservoir that will be displayed on the LCD.

Keywords: Ultrasonic, Arduino, LCD.

I. INTRODUCTION

The ceramic industry is an industry that produces tile or wall kramik products. The products produced include ceramics of various sizes [1],[2]. The process in production there are several stages including from clay material that is crushed with a crusher machine [3],[4]. The second process is the mixing or processing of clay from the crusher machine which will be produced into slurry material using a time continuous milling machine (MTC) [5],[6]. The spray dryer pump machine is used to distribute slurry from the reservoir center to the ATM 140 reservoir and this machine works in continuous, which is 50 meters away [7],[8]. In ATM 140 reservoirs, there is often an overload slurry because the security system still uses a switch to activate the alarm, the manual machine still affects one of the factors [9],[10]. Factors include performance, ATM 140 machine operator workers will work extra to turn off the pump manually, besides that operator workers also do not know about blockages in the spray dryer pipe [11],[12]. However, because the machine works continuously, the result is that it often experiences flooding at the ATM 140 reservoir [12],[13]. With these problems, the monitoring system tool to find out the performance system of the slurry pump, and automatic control of the slurry pump to reduce problems from overload slurry, and in the ATM 140 reservoir will be installed HC SR04 sensor to detect the distance or volume of slurry on the ATM 140 reservoir which will show what percentage of the contents of the reservoir will be displayed on the LCD monitoring screen, In this study, the author will design a tool for a Slurry Transfer Control and Monitoring System on an

Atm 140 Spray Dryer Using An Ultrasonic Sensor Based Microcontroller. In this study, there are several objectives, namely as follows [14],[15],[16].

- 1) Knowing the components needed in the slurry transfer control and monitoring system on the ATM 140 spray dryer.
- 2) Knowing the performance of the control system and monitoring the ATM 140 slurry transfer pump by microcontroller.
- 3) Knowing the performance of the monitoring system at the ATM 140 reservoir

II. METHODS

A. Product Design

1. Research Phase

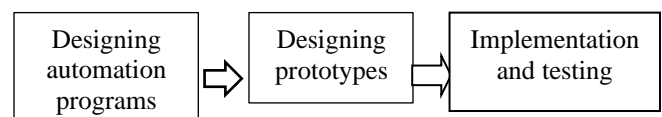


Figure 1. Research Phase

This research seeks to provide an ease to the production operator so that it can easily control in the slurry transfer system with a monitoring. So the operator does not need to manually turn off the slurry pump with a distance of 50M, the operators only need to monitor inside the control panel with a monitoring system.

2. Product Design Design

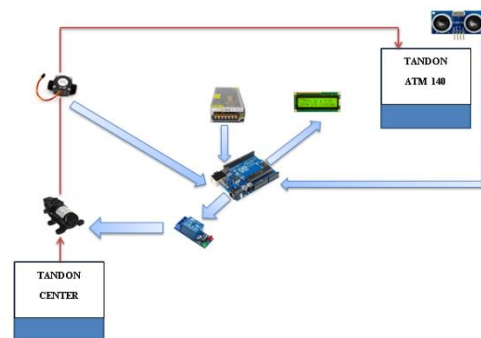


Figure 2. Product design

3. Diagram Block

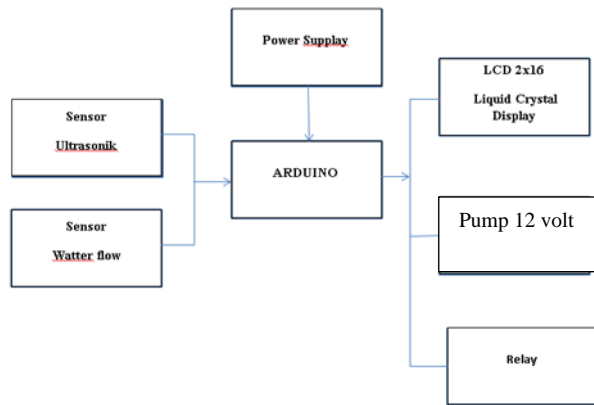


Figure.3 Block diagram

In figure 3. block diagram using ultrasonic and water flow sensors on the slurry transfer monitoring system at TANDON ATM 140. This part of the diagram is part of a circuit that can be arranged into a central control system. In the block section the input system diagram uses ultrasonic sensor HC-SR04 and water flow sensor and for the output part is located on the LCD and 12volt pump. In the picture of the tool above, it has several parts, namely:

- 1) The ultrasonic sensor section uses HC-SR04 which can be used as a discharge meter or volume slurry on the ATM 140 tendon which is detected at a distance and can be stored in the Arduino program.
- 2) The water flow part of this sensor is used to measure the slurry discharge in the distribution in the pipe
- 3) On the Arduino it can function as a microcontroller to produce input and output
- 4) The ultrasonic sensor section using HC-SR04 can function to measure the discharge or slurry volume at the ATM 140 tendon which is detected at a distance and can be stored in the arduino program.
- 5) The water flow part of this sensor is used to measure the slurry discharge in the distribution in the pipe
- 6) In the arduino section is one of the systems that can be used as a microcontroller to produce inputs and outputs
- 7) The LCD section has an output that can be used to see the results of volume measurements in the slurry in the ATM 140 tendon.
- 8) The pump part is used to distribute slurry from the reservoir center to the ATM 140 reservoir.
- 9) The relay is used to process the on/off on the pump automatically.
- 10) Power supply is used to apply voltage to the arduino.

Flowchart Measurement of Volume And Height of Slurry

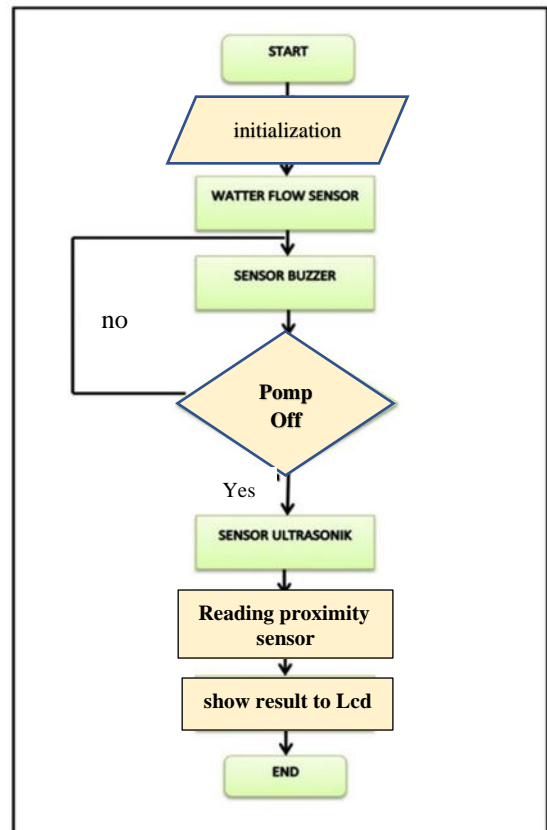


Figure. 4 flowchart

Product Test Finished making a design system, then there will be a next stage, namely withstanding tool testing, for this stage which is in essence to test the tool thoroughly, in order to find out how the tool performs.

- 1) Testing Arduino Atmega 328 On this component will be tested which will be connected to the Arduino via the input pin contained in the board. And it is connected to a voltage source to ensure that the components run according to the research.
- 2) Testing Sensor Ultrasonic HC_SR04. In sensor ultrasonic, it is a test that will be carried out on the sensor to determine the slurry distance test on a reservoir. in order to be able to find out the percentage of errors on the sensor.
- 3) Water Flow Testing On the water flow sensor, the test will be carried out on the slurry pipe to determine the discharge and flow in the piping.
- 4) Power Supply testing in a power supply test is to convert to find out the voltage source at the power supply output.
- 5) LCD testing In LCD testing by connecting through pins on the board, to test the system on the LCD to ensure the pins on the LCD run according to the research
- 6) Relay testing in relay testing can be done with the on / off button in the microcontroller program to find out the system on the automation pump

III. RESULTS AND DISCUSSION

In this section, it is the result and discussion of research. At the time of designing and manufacturing the slurry transfer monitoring system tool. This tool is used for tool modification in the industrial world. Because it can make it easier for employer to control the slurry level on the reservoir.

Components Used and Installed

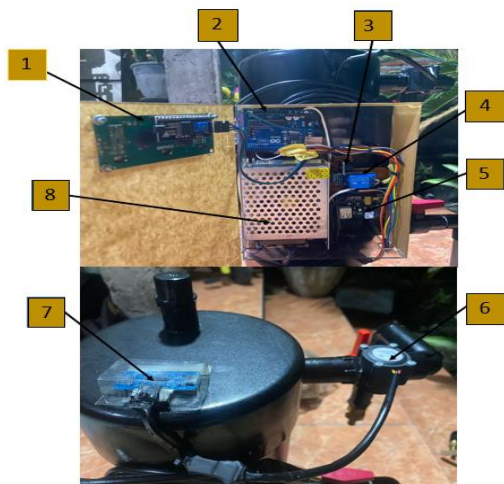


Figure.5 suite

- 1) LCD 2x16
- 2) Arduino uno
- 3) Buzzer
- 4) Relay
- 5) Bread board power supply
- 6) Flowmeter
- 7) Ultrasonic sensor HC-SR04
- 8) Power Supply

HC-SR04 Sensor Testing In this test, it uses a reservoir as an object that will be detected distance by the sensor and the ruler band for distance measurement. The measurement results are shown in the table below.

Tabel 1 Sensor Reading Results

Distance	Measurements On The Measuring Band	Results On The Monitor
5 cm	90%	90%
10 cm	72%	72%
15 cm	54%	54%
20 cm	32%	32%
25 cm	21%	21%
30 cm	0%	0%

Manual measuring distance	Sensor output measuring distance
5 cm	90%
10 cm	72%
15 cm	54%
20 cm	32%
25 cm	21%
30 cm	0%
average	43%

Figure.6 data sensor reading results

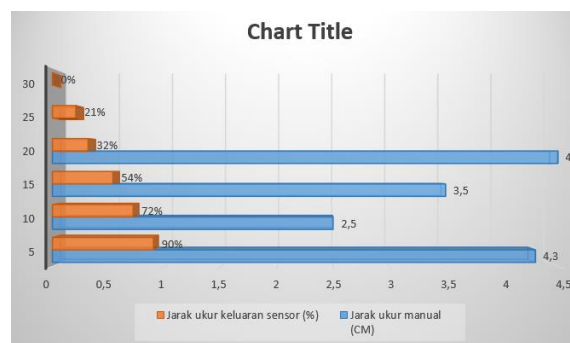


Figure. 7 data analysis graph

HC-SR04 Against Distance Accuracy

In withstanding this test, it is carried out by placing on an object whose different measuring distances have been measured using a ruler. Measurement limits in from 5-30cm. With a difference of 5cm, this aims to find out the level to the accuracy of the sensor distance to the object. The measurement results are shown in table 4.

Based on table 4 and figure 17 of the HCSR04 sensor test against the accuracy of the distance that has been set at 5-30cm. The result obtained on the sensor is that the sensor is able to read the distance well at a distance of 15cm while at a distance of 20cm and above the level to the average difference of error is 43%.

Table 2 Delay Test Results On HC-SR04 Sensor

NO	Number of Initial Percentages	Final Percentage Results
1	90	75%
2	90	74%
3	90	70%
4	91	75%
5	92	76%
6	90	73%
7	90	75%
8	90	70%
9	90	70%
10	90	74%
Difference rate		73%

No	Measuring Cup Water(ml)	Number of levels(ml)	Difference rate
1.	250	247	3
2.	250	247	3
3.	250	249	1
4.	250	248	2
5.	250	249	1
6.	250	248	2
7.	250	247	3
8.	250	249	1
9.	250	249	1
10.	250	249	1
			1.8

In testing the YF-S201 flow meter sensor put water on the level measuring geles. This test is carried out by pouring as much as 250ml of water In this measurement, it can be concluded that there are several data samples that are used as a difference in the flow of water on the measuring cup using the YF-S201 water flow sensor. So that it can be calculated the amount of difference arising in the measurement parameters mentioned in the table.

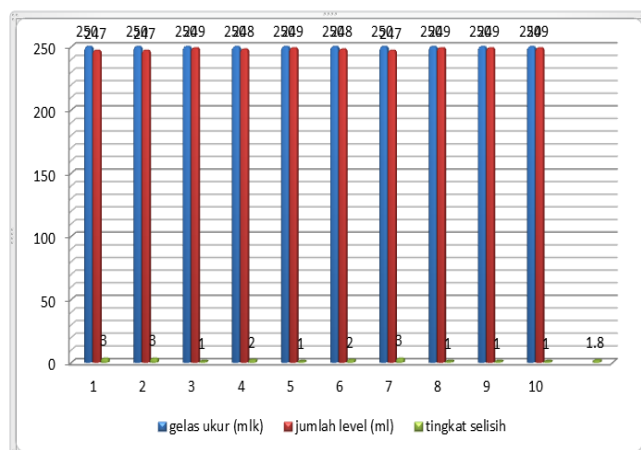


Figure. 8 analysis graph

IV. CONCLUSION

From the results of planning to testing, the author can draw conclusions, namely as follows:

- 1) Successfully made a slurry transfer monitoring control system using the HC-SR04 sensor as a reservoir level detection,
- 2) The author succeeded in assembling and making a microcontroller-based slurry transfer monitoring system where the tool can run as the system is run by the tool detecting the reservoir level and sending the results to the LCD. With relatively small accuracy.
- 3) When measuring the flowmeter using 250ml of water, random measurement results were obtained, which was caused by the influence on the pump pressure.
- 4) At the time of measurements with increasingly long distances, the measurements on the measuring tape are getting smaller and smaller.

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